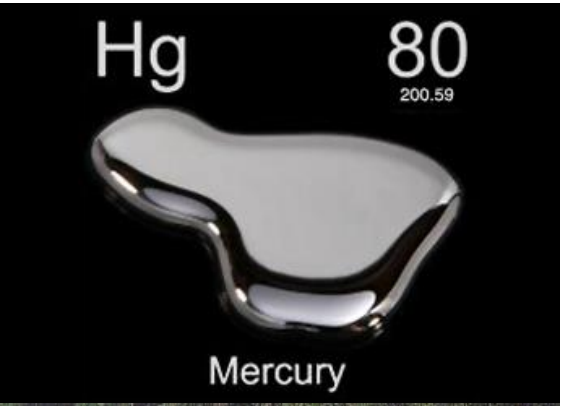


SF Bay Mercury Information Needs and Hg TMDL Implementation

Richard Looker
SF Bay Regional Water Quality Control Board
December 17, 2013
Science to Support Management of Methylmercury in Restored Tidal Marshes

Water Quality Regulation Basics: The Basin Plan

- Master Planning Document
  - Regulatory
    - Beneficial Uses
    - Water Quality Objectives
    - Implementation Program
  - Information
    - Maps, tables, plans & policies, program descriptions, & related regulations

Beneficial Uses in Marine and Estuarine Wetlands Must be Protected

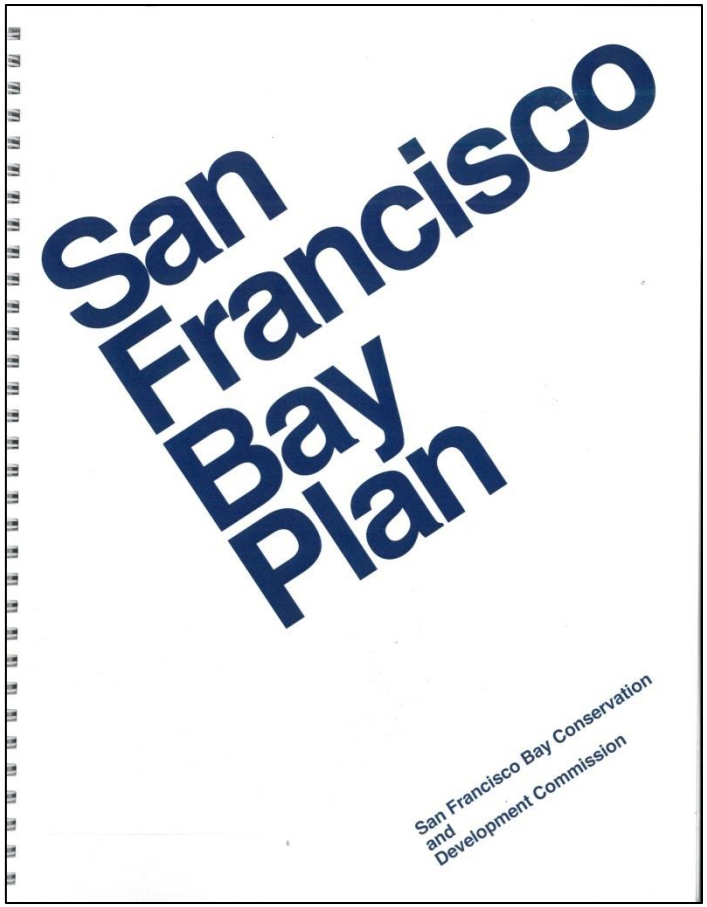
- Protection of Rare and Endangered Species
- Commercial and Sportfishing
- Wildlife Habitat
- Estuarine Habitat
- Groundwater Recharge
- Fish Migration

* Drivers of the SF Bay Hg TMDL

Coastal Zone Management Plan: BCDC's San Francisco Bay Plan

Policy Guidance for Regulatory Actions

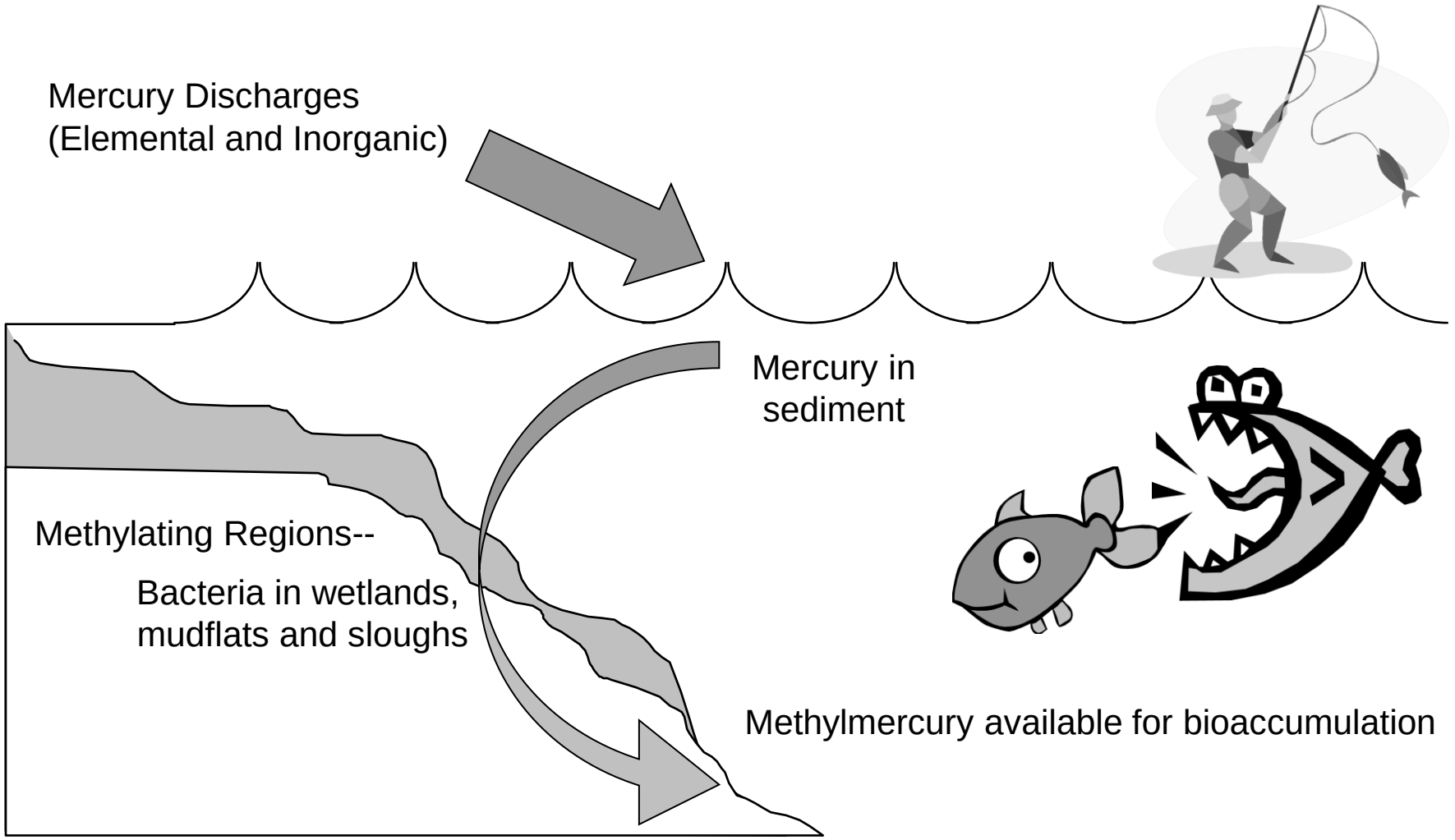
- Tidal Marsh and Mudflats
- Fish, Other Aquatic Organisms and Wildlife
- Water Quality
- Dredging



Mercury Impairs Several San Francisco Bay Beneficial Uses

- Sport Fishing
  - Fish consumption advisory
- Wildlife Habitat
  - Mercury in bird eggs accounts for hatch failures
- Preservation of Rare and Endangered Species
  - e.g., California Clapper Rail and California Least Tern

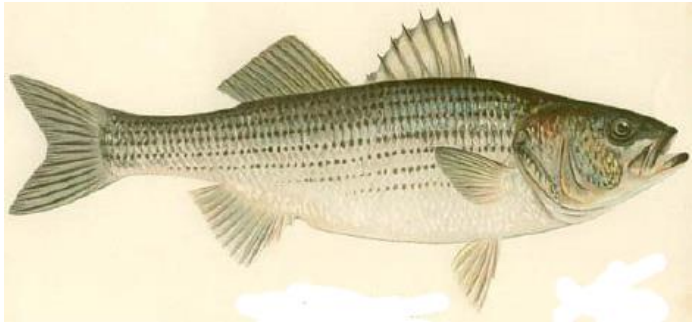
TMDL Conceptual Model for Mercury Fate: All Mercury Could Enter Food Web



TMDL Summary and Key Assumptions

- Mercury loading reduced from 1200 to 700 kg/yr.
  - Assimilative capacity based on simple model
  - Large reductions from Central Valley, Guadalupe River, urban runoff, in-bay bed erosion
- No load allocation for wetlands because not a source of total mercury.
- But, concern for wetland role in methylation and bioaccumulation informs implementation approach.

Relevant U.S. EPA-approved Water Quality Objectives in SF Bay



0.2 ppm mercury
in large predator fish

California least tern

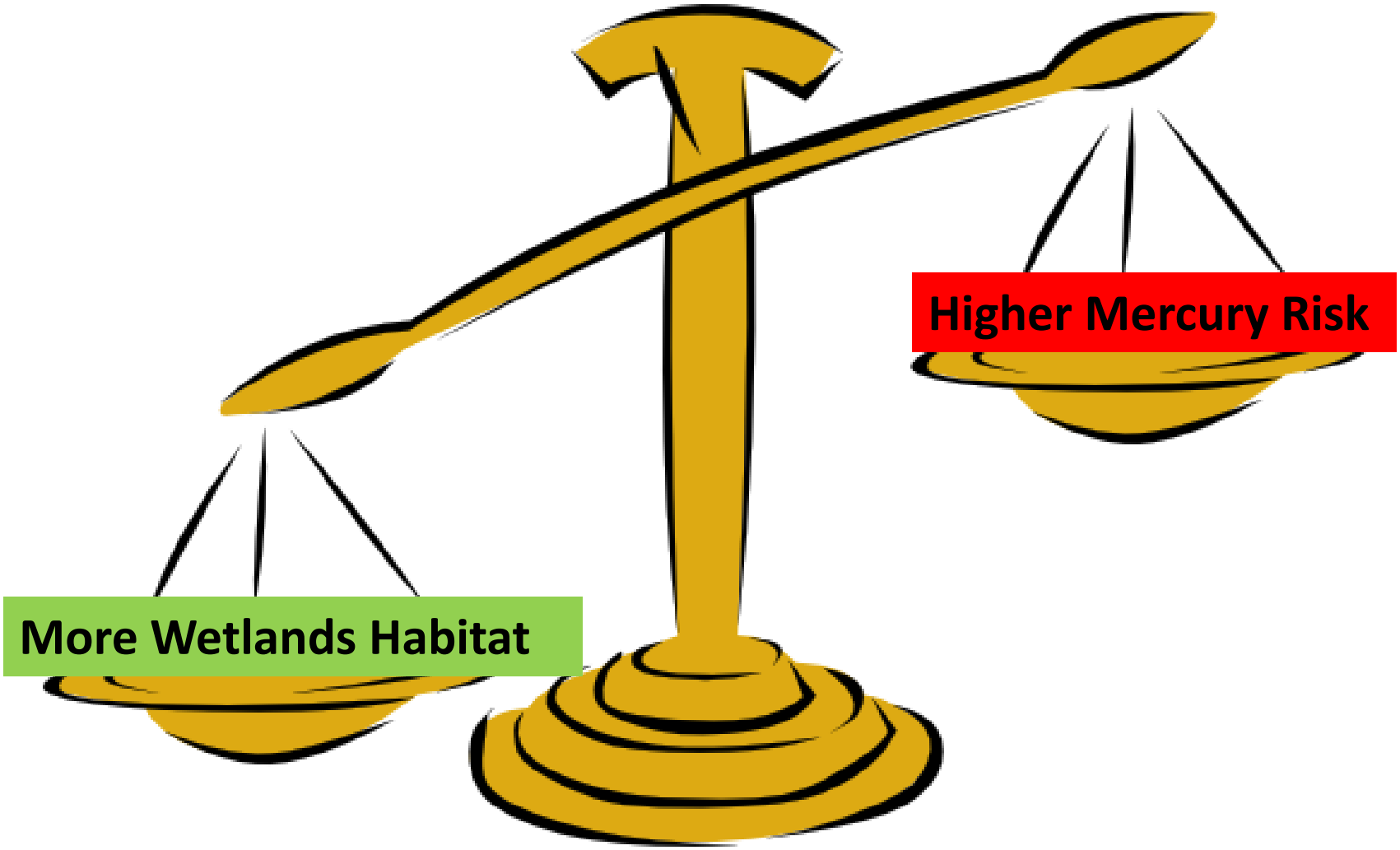
0.03 ppm mercury
in prey fish

TMDL implementation for wetlands

- The TMDL recognizes that wetlands:
  - are beneficial (avoid regulation impeding restoration), but they
  - may contribute to methylmercury production and food web levels.
  - Large-scale wetland restoration in the region may, therefore, lead to increased mercury methylation and incorporation into food web.

- TMDL requires permit provisions that restored wetlands should:
  - be designed and operated to minimize methylmercury production and biological uptake, and
  - result in no net increase in mercury or methylmercury loads to Bay.
  - Projects must include pre- and post-restoration monitoring to demonstrate compliance.

Increased wetlands habitat may mean more mercury Risk



We must meet water quality objectives and comply with the mercury TMDL

..and we also must protect beneficial uses in wetlands and comply with relevant wetland policies

But wetlands have conditions favorable for mercury methylation and bioaccumulation

Ugh! Mercury bioaccumulation and wetlands are complex!

I need some information to regulate responsibly.

Wetland Restoration is a good thing, right? Afterall we need the habitat…

Thoughtful Wetland Regulator

How Regulators Might Use Information

- Pre-breach monitoring/studies
  - Can we safely breach?
  - Inform restoration design changes.
  - Inform management measures for projects
  - Inform monitoring/study requirements
- Post-breach and regional monitoring/studies
  - Implement adaptive management (if possible)
  - Inform design at other projects
  - Inform management at other projects
  - Inform enhanced monitoring/study requirements

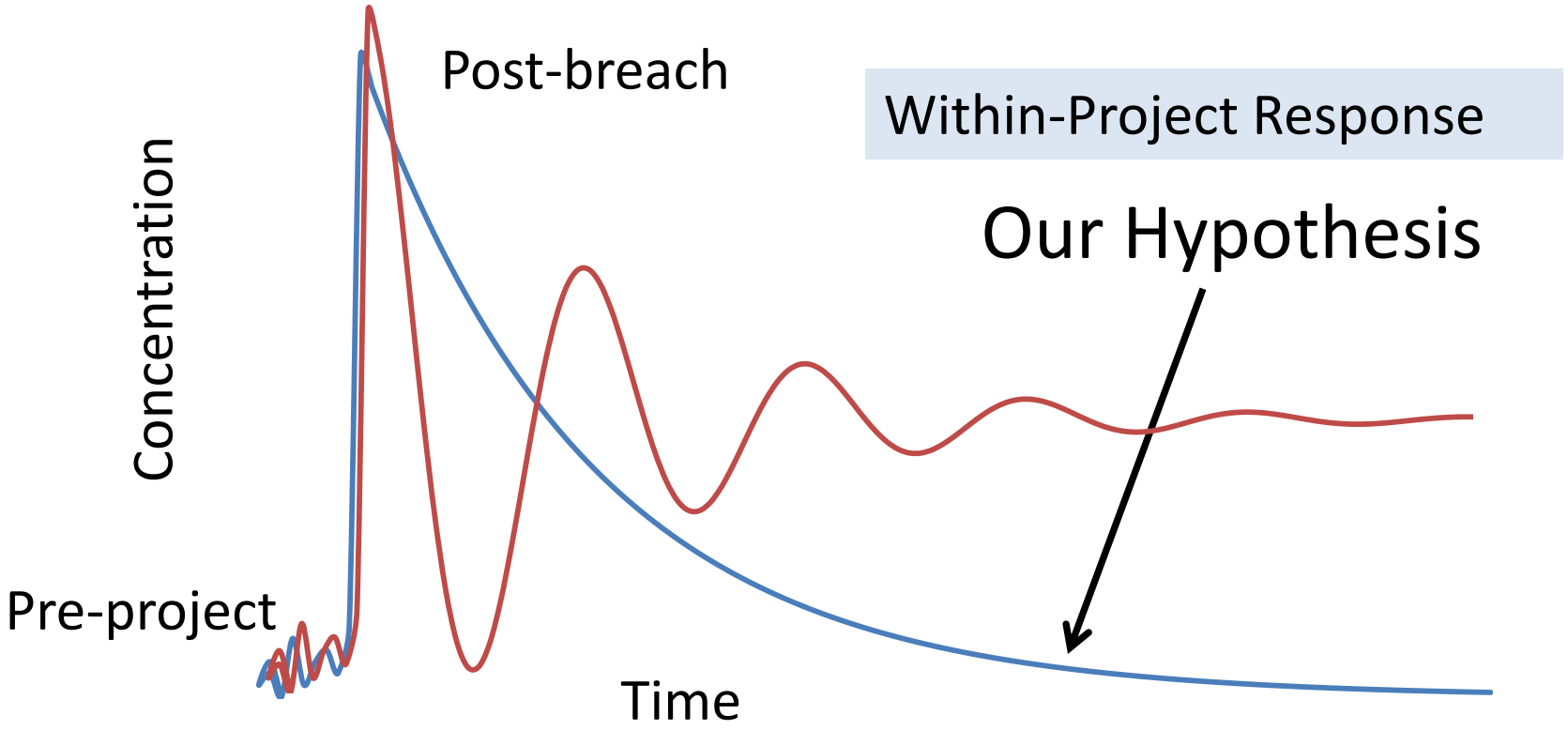
Wetland/Mercury Information Needs

- These are some (but not all) of the key information needs of regulators:

1. Short and long term effects
2. Local and regional impacts
3. Monitoring study design
4. Restoration design and management actions

Topic 1: Short-term vs Long-term Effects

MQ1: What is the effect of increased tidal action and impact on methylmercury bioaccumulation in wildlife, within the project and downstream, over timescales of about one year and longer than one year?



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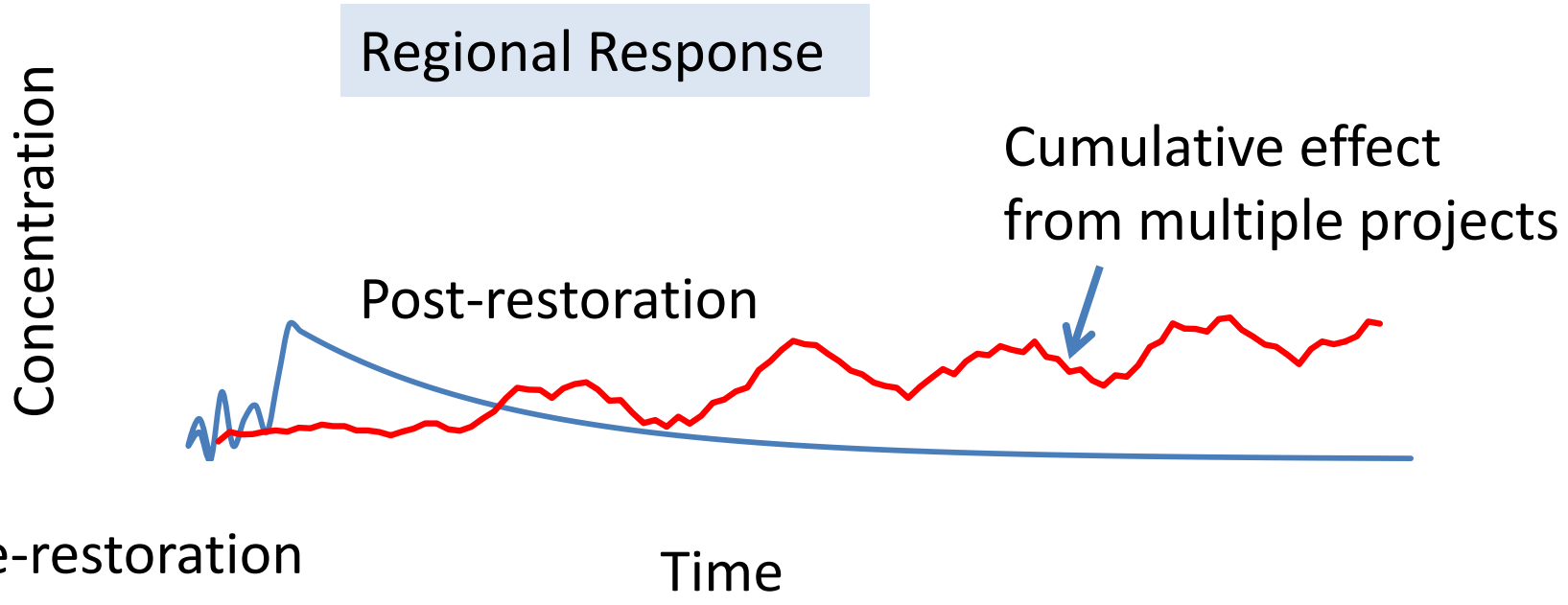


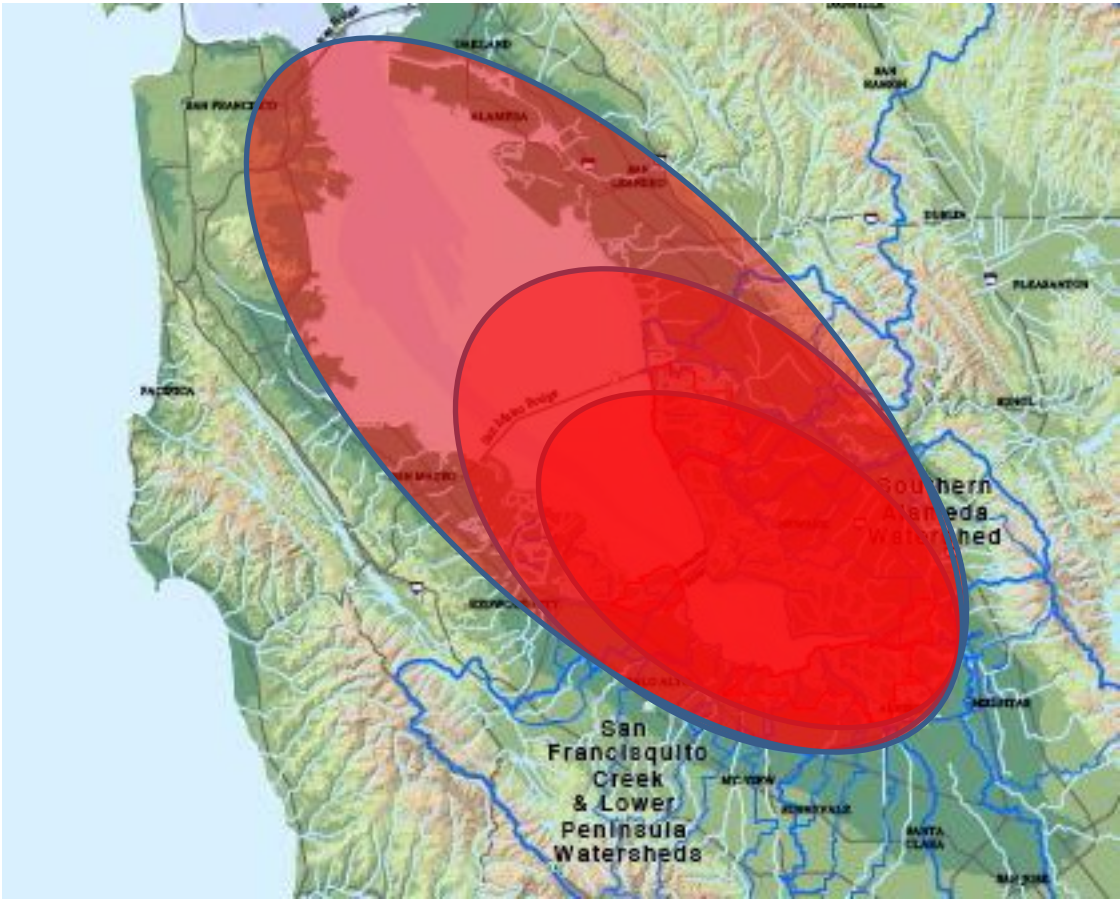
Topic 2: local and regional impacts

MQ2: What are the local (in or near project) versus regional environmental impacts due to restoration?

Hypotheses:

Methylmercury loading from restoration projects should **not** be a factor for Bay-wide impairment.

We do not expect to be able to measure regional impacts to Bay's food web from tidal wetland restoration projects.



Topic 3: Study Design

Principle 1: Measuring mercury in biosentinel species provides information on key management questions and helps identify when and where process studies should be performed.

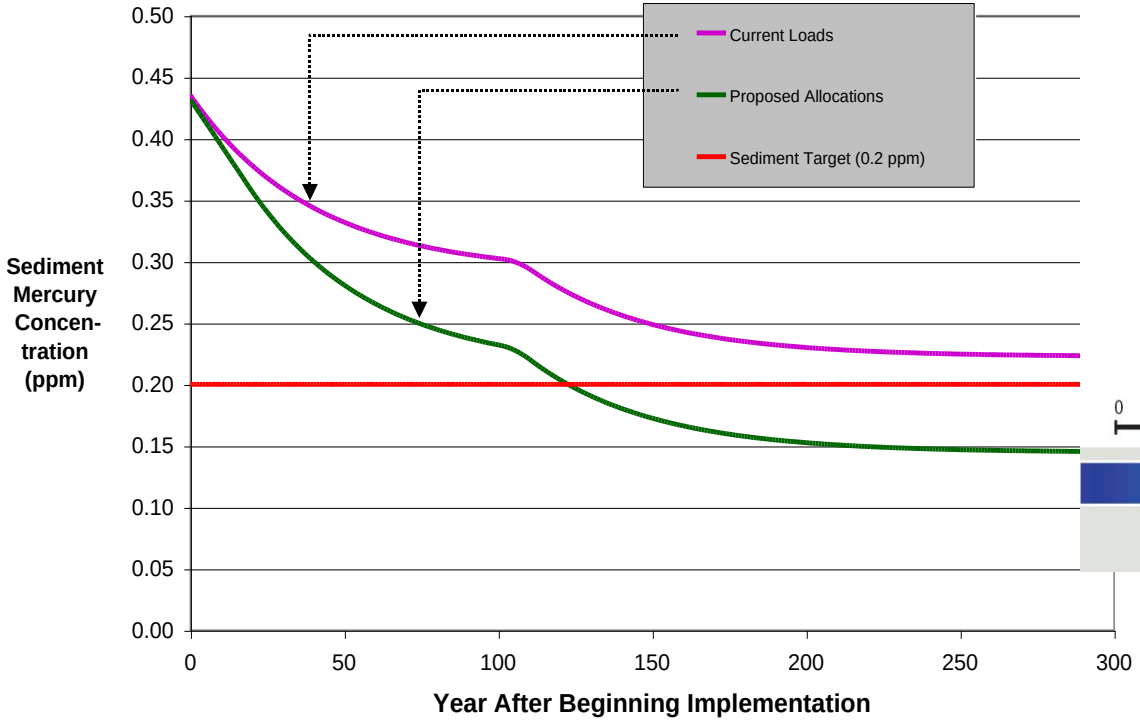
Principle 2: Process studies are important components of answering several management questions, but should be done probably at a subset of sites.

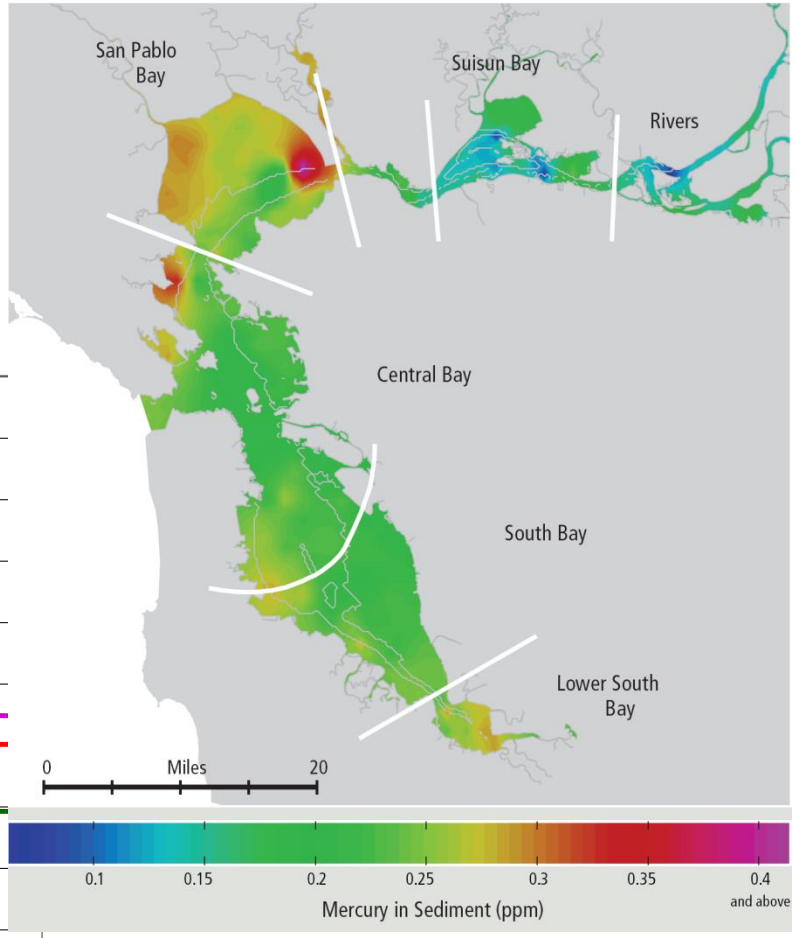
Principle 3: The monitoring program should have a regional scope to ensure that data are relatively consistent across projects so that site-specific variability may be distinguished from regional trends and phenomena.



Don’t forget about the Bay

- Lots more wetlands restored
- Need wetland scale AND Bay-scale regional monitoring to track status and detect possible impacts from restored wetlands





Topic 4: Restoration Design and Management Actions

MQ6: What do we know about designing and managing restoration projects to reduce the risk of mercury impairment (e.g., incorporation of methylmercury into the food web)?

Hypotheses:

We do not **yet** have sufficient information to design tidal marsh restoration projects to reduce methylmercury exposure.

It is **possible** to do so.

We have many more questions !

- What are the best indicator species?
- What are thresholds of concern in these species?
- What about other types of systems (e.g., managed ponds)
- What will be the impacts of climate change?
- How can we measure the net benefits of wetland restoration and compare to overall risk relative to mercury?

2. What are the local and regional impacts due to restoration projects?

3. How should we design appropriate monitoring and process studies in restored systems?

1. What are the short-term and long-term effects of restoration?

4. How can we design or manage restored systems to reduce risk of mercury impairment?

The menu of topics for today's forum